

10/519628

DT15 PCT/PTO 30 DEC 2004

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Paulo BARSCEVICIUS et al.

Attn: PCT Branch

Application No. New U.S. National Stage of PCT/FI03/000535

Filed: December 30, 2004

Docket No.: 122255

For: METHOD AND APPARATUS FOR MEASURING AND ADJUSTING THE
SETTING OF A CRUSHER


**SUBMISSION OF THE ANNEXES TO THE
INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached hereto is a translation of the annexes to the International Preliminary Examination Report (Form PCT/IPEA/409). The attached translated material replaces the claims.

Respectfully submitted,


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PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 39814	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/FI 2003/000535	International filing date (day/month/year) 02.07.2003	Priority date (day/month/year) 05.07.2002
International Patent Classification (IPC) or national classification and IPC B02C 1/00, B02C 2/00, B02C 7/12, B02C 25/00		
Applicant METSO MINERALS (TAMPERE) OY et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
 - ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 12.01.2002	Date of completion of this report 04.10.2004
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Fredrik Andersson/MP Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/ 2003/000535

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-15 _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 17-20 received by this Authority on 21.06.2004

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-7 _____ as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (*specify*): _____

☐ any table(s) related to the sequence listing (*specify*): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-20</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-20</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-20</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Document cited in the International Search Report:

D1: WO 01067044 A3

New claims have been filed on 21 June 2004.

New independent claims 1 and 4

D1 is considered to represent the closest prior art. From D1 (see page 1, lines 10-24; page 30 line 22 - page 31, line 11 and claim 1), a method and apparatus for monitoring various quantities in the wearing parts of a crusher are known; especially for monitoring temperature. The apparatus and method in D1 comprise a control system, wireless information transmission and sensors.

What substantially differs between the invention according to claims 1 and 4 and D1 is the method by which the setting of the crusher during the crushing process is monitored and measured, i.e. measuring the erosion of the wear parts. In D1 nothing is mentioned or hinted at concerning how the measurement can take place.

Therefore, the invention according to new independent claims 1 and 4 is novel and considered to have inventive step.

The invention is industrially applicable.

What is claimed is:

1. A method for measuring and monitoring the setting of a crusher during the crushing process, in which method the erosion of the wearing parts of a crusher is measured and the setting of a crusher is adjusted based on the measurement result so as to maintain the setting at a predetermined value irrespective of the erosion of the wearing parts, **characterized** in that the measurement data indicating the amount of erosion in at least two of the wearing parts defining the setting of the crusher is transmitted wirelessly to the exterior side of the crusher.
2. The method of claim 1, **characterized** in that the erosion of each of the wearing parts defining the setting of the crusher is measured.
3. The method of claim 1 or 2, **characterized** in that a wearing part replacement order is automatically issued as soon as the measurement data indicating the amount of erosion in the wearing parts reaches a predetermined threshold value.
4. An apparatus for measuring and monitoring the setting of a crusher during crushing, the apparatus comprising at least two crusher liners defining the setting of the crusher, at least one wear sensor mounted on first crusher liner, means for adjusting the crusher setting, at least one sensor mounted on said means for adjusting the crusher setting and an automatic control system of the crusher, in which apparatus said crusher's automatic control system receives a first input signal from a wear sensor mounted on the first liner of the crusher, said first input signal being suitable for determination of amount of erosion in said liner, and a second input signal from said sensor mounted on the setting adjustment means of the crusher, said second input signal being suitable for determination of the relative position of the support surfaces of the crusher's wearing parts, whereby the crusher's automatic control system is able based on both input signals to adjust the crusher setting so as to maintain the setting of the crusher in its predetermined value irrespective of the erosion of the first wearing part, **characterized** in that at least one second wear measurement sensor is mounted on the other of the crusher liners defining the setting

of the crusher together with the first wear liner, in which apparatus said crusher's automatic control system receives a third input signal from the second wear sensor, said third input signal being suitable for determination of amount of erosion in said second liner, and that said sensors are equipped with means for transmitting the measurement data wirelessly to the exterior side of the crusher.

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5. The apparatus of claim 4, **characterized** in that the crusher's automatic control system includes means for receiving said wirelessly transmitted data.
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6. The apparatus of claim 4 or 5, **characterized** in that said sensors are equipped with means for generating the electrical energy required for the operation of the sensors.
- 15
7. The apparatus of claim 6, **characterized** in that said means for generating the electrical energy required for the operation of the sensors comprise elements suitable for converting kinetic energy into electrical energy.
- 20
8. The apparatus of claim 6, **characterized** in that said means for generating the electrical energy required for the operation of the sensors comprise a piezoelectric device.
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- 25
9. The apparatus of claim 6, **characterized** in that said means for generating the electrical energy required for the operation of the sensors comprise means for generating energy from an electromagnetic field surrounding the crusher.
- 30
10. A sensor suitable for use in any one of the apparatuses disclosed in claims 4-9 for measuring the amount of erosion in the wearing parts of a crusher, **characterized** in that the wearing portion of the sensor comprises a resistor network formed by a plurality of resistors in parallel, whereby the resistors along with the erosion of the wearing part in the crusher become erosively disconnected from the resistive network thus changing the overall resistance of the circuit feeding current to the wear sensor, whereby a measurement signal proportional to the amount of erosion in the wearing

part is generated.

11. A sensor suitable for use in any one of the apparatuses disclosed in claims 4-9 for measuring the amount of erosion in the wearing parts of a crusher, **characterized in**
5 that the wearing portion of the sensor comprises a resistor network formed by a plurality of resistors in series, whereby the resistors along with the erosion of the wearing part in the crusher become erosively disconnected from the resistive network thus changing the overall resistance of the circuit feeding current to the wear sensor, whereby a measurement signal proportional to the amount of wearing part erosion is
10 generated.

12. A sensor suitable for use in any one of the apparatuses disclosed in claims 4-9 for measuring the amount of erosion in the wearing parts of a crusher, **characterized**
15 in that the sensor is implemented such that the sensor utilizes acoustic waves.

13. The sensor of claim 12, **characterized in** that the sensor is an ultrasonic sensor.

14. The sensor of claim 12, **characterized in** that the sensor is implemented using MEMS technology in the sensor construction.

15. The sensor of claim 14, **characterized in** that the sensor is an acoustic emission
20 detecting sensor.

16. The sensor of any one of claims 12-15, **characterized in** that the sensor
25 incorporates separate means for emitting and receiving a sensing impulse.

17. A sensor suitable for use in any one of the apparatus disclosed in claims 4-9 for measuring the amount of erosion in the wearing parts of a crusher, **characterized in**
30 that the sensor is based on a strain gage element.

18. The sensor of claim 17, **characterized in** that the sensor is also capable of measuring forces imposed on the wearing part during crushing.

19. The sensor of claim 17 or 18, **characterized** in that the sensor incorporates means for storing and wirelessly transmitting the identification data of the wearing part.

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20. The sensor of any one of claims 17-19, **characterized** in that RF technology is used in the implementation of at least a portion of the sensor elements.